

IN THE CLAIMS:

The following is a complete listing of the claims, and replaces all earlier version and listings.

1. (original): An image processing apparatus for quantizing multilevel color image data containing at least two kinds of color components, comprising:
 - error addition means for adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;
 - a threshold table which stores a quantization threshold for each of the color components in accordance with a combination of color component values of pixels;
 - modulation amount determination means for determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel; and
 - quantization means for acquiring a threshold for each color component from said threshold table in accordance with a combination of color components of the target pixel, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added by said error addition means.

2. (original): The apparatus according to claim 1, wherein said modulation amount determination means determines a threshold modulation amount for each color in accordance with a combination of color component values of the target pixel.

3. (original): The apparatus according to claim 1, wherein said modulation amount determination means determines a threshold modulation amount for each color in accordance with a combination of average values, maximum values, or minimum values of color components of the target pixel and a neighboring pixel thereof.

4. (original): An image processing apparatus for quantizing multilevel color image data containing at least two kinds of color components, comprising:

error addition means for adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

quantization means for quantizing each color component of the target pixel;
and

a diffusion coefficient table which stores a diffusion coefficient for diffusing a quantization error produced by said quantization means, in accordance with a combination of color component values of a pixel,

wherein said error addition means adds an error value to the target pixel in accordance with a combination of color components of the target pixel and a diffusion coefficient selected from said diffusion coefficient table.

5. (original): The apparatus according to claim 4, wherein said error addition means selects a diffusion coefficient from said diffusion coefficient table in accordance with a combination of color component values of the target pixel.

6. (original): The apparatus according to claim 4, wherein said error addition means selects a diffusion coefficient from said diffusion coefficient table in accordance with a combination of average values, maximum values, or minimum values of color components of the target pixel and a neighboring pixel thereof.

7. (original): The apparatus according to claim 4, wherein said error addition means selects a diffusion coefficient from said diffusion coefficient table in accordance with a product of color component values of the target pixel and a neighboring pixel thereof.

8. (original): An image processing apparatus for quantizing multilevel color image data containing at least two kinds of color components, comprising:

error addition means for adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a threshold table which stores a quantization threshold for each of the color components in accordance with a combination of color component values of pixels;

modulation amount determination means for determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel;

quantization means for acquiring a threshold for each color component from said threshold table in accordance with a combination of color components of the target pixel, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added by said error addition means; and

a diffusion coefficient table which stores a diffusion coefficient for diffusing a quantization error produced by said quantization means, in accordance with a combination of color component values of a pixel,

wherein said error addition means adds an error value to the target pixel in accordance with a combination of color components of the target pixel and a diffusion coefficient selected from said diffusion coefficient table.

9. (currently amended): An image processing apparatus for quantizing multilevel color image data containing at least three kinds of color components, comprising:

error addition means for adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a threshold table which stores a quantization threshold for each of the color components in accordance with a combination of color component values of pixels;

modulation amount determination means for determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel; and

quantization means for acquiring a threshold for each color component from said threshold table in accordance with a combination of color components of the target pixel, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added by said error addition means,

wherein a combination of two kinds of color components is quantized by [[an]] said image processing apparatus defined in claim 1, and a remaining color component is quantized by the image processing apparatus defined in claim 1 with a value of a color component other than a target color component being regarded as 0.

10. (original): An image processing method of quantizing multilevel color image data containing at least two kinds of color components, comprising:

an error addition step of adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a modulation amount determination step of determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel; and

a quantization step of acquiring a threshold for each color component, in accordance with a combination of color components of the target pixel, from a threshold table which stores a quantization threshold for each of the color components in accordance with a combination of color component values of pixels, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added in the error addition step.

11. (original): The method according to claim 10, wherein in the modulation amount determination step, a threshold modulation amount for each color is determined in accordance with a combination of color component values of the target pixel.

12. (original): The method according to claim 10, wherein in the modulation amount determination step, a threshold modulation amount for each color is determined in accordance with a combination of average values, maximum values, or minimum values of color components of the target pixel and a neighboring pixel thereof.

13. (original): An image processing method of quantizing multilevel color image data containing at least two kinds of color components, comprising:

an error addition step of adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel; and

a quantization step of quantizing each color component of the target pixel

wherein in the error addition step, an error value is added to the target pixel in accordance with a combination of color components of the target pixel and a diffusion coefficient selected from a diffusion coefficient table which stores a diffusion coefficient for diffusing a quantization error produced in the quantization step, in accordance with a combination of color component values of a pixel.

14. (original): The method according to claim 13, wherein in the error addition step, a diffusion coefficient is selected from the diffusion coefficient table in accordance with a combination of color component values of the target pixel.

15. (original): The method according to claim 13, wherein in the error addition step, a diffusion coefficient is selected from the diffusion coefficient table in accordance with a combination of average values, maximum values, or minimum values of color components of the target pixel and a neighboring pixel thereof.

16. (original): The method according to claim 13, wherein in the error addition step, a diffusion coefficient is selected from the diffusion coefficient table in

accordance with a product of color component values of the target pixel and a neighboring pixel thereof.

17. (currently amended): An image processing method of quantizing multilevel color image data containing at least two kinds of color components, comprising:

an error addition step of adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a modulation amount determination step of determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel; and

a quantization step of acquiring a threshold for each color component, in accordance with a combination of color components of the target pixel, from a threshold table which stores a quantization threshold for each of the color components, in accordance with a combination of color component values of pixels, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added in the error addition step,

wherein in the error addition step, an error value is added to the target pixel in accordance with a combination of color components of the target pixel and a diffusion coefficient selected from a diffusion coefficient table which stores a diffusion coefficient

for diffusing a quantization error produced in the quantization step in accordance with a combination of color component values of a pixel.

18. (currently amended): An image processing method of quantizing multilevel color image data containing at least three kinds of color components, comprising:

an error addition step of adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a modulation amount determination step of determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel; and

a quantization step of acquiring a threshold for each color component, in accordance with a combination of color components of the target pixel, from a threshold table which stores a quantization threshold for each of the color components in accordance with a combination of color component values of pixels, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added in the error addition step,

wherein a combination of two kinds of color components is quantized by [[an]] said image processing method defined in claim 10, and a remaining color component

is quantized by the image processing method defined in claim 10 with a value of a color component other than a target color component being regarded as 0.

Claims 19. - 26. (canceled).

27. (currently amended): A computer-readable medium encoding a computer program product for causing a computer to quantize multilevel color image data containing at least two kinds of color components, said program comprising:

a code for an error addition step of adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a code for a modulation amount determination step of determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel; and

a code for a quantization step of acquiring a threshold for each color component from a threshold table in accordance with a combination of color components of the target pixel, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added in the error addition step.

28. (currently amended): The product medium according to claim 27, wherein in the modulation amount determination step, a threshold modulation amount for

each color is determined in accordance with a combination of color component values of the target pixel.

29. (currently amended): The product medium according to claim 27, wherein in the modulation amount determination step, a threshold modulation amount for each color is determined in accordance with a combination of average values, maximum values, or minimum values of color components of the target pixel and a neighboring pixel thereof.

30. (currently amended): A computer-readable medium encoding a computer program product for causing a computer to quantize multilevel color image data containing at least two kinds of color components, said program comprising:

a code for an error addition step of adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a code for a quantization step of quantizing each color component of the target pixel; and

a diffusion coefficient table,

wherein in the code for the error addition step, a diffusion coefficient is selected, in accordance with a combination of color components of the target pixel, from a diffusion coefficient table which stores a diffusion coefficient for diffusing the quantization error in accordance with a combination of color component values of a pixel, and an error value is added to the target pixel in accordance with the selected diffusion coefficient.

31. (currently amended): The product medium according to claim 30, wherein in the error addition step, a diffusion coefficient is selected from the diffusion coefficient table in accordance with a combination of color component values of the target pixel.

32. (currently amended): The product medium according to claim 30, wherein in the error addition step, a diffusion coefficient is selected from the diffusion coefficient table in accordance with a combination of average values, maximum values, or minimum values of color components of the target pixel and a neighboring pixel thereof.

33. (currently amended): The product medium according to claim 30, wherein in the error addition step, a diffusion coefficient is selected from the diffusion coefficient table in accordance with a product of color component values of the target pixel and a neighboring pixel thereof.

34. (currently amended): A computer-readable medium encoding a computer program product for causing a computer to quantize multilevel color image data containing at least two kinds of color components, said program comprising:
a code for an error addition step of adding a quantization error value distributed from a neighboring pixel for each color component to each of a plurality of color components contained in a target pixel;

a code for a modulation amount determination step of determining a threshold modulation amount of each color in accordance with a combination of color component values of pixels including the target pixel; and

a code for a quantization step of acquiring a threshold for each color component, in accordance with a combination of color components of the target pixel, from a threshold table which stores a quantization threshold for each of the color components in accordance with a combination of color component values of pixels, determining a threshold modulated by adding the modulation amount to the threshold for each color, and quantizing the target pixel in accordance with a relationship in magnitude between the modulated threshold and a value of each color component to which an error value is added in the error addition step.

wherein in the code for the error addition step, a diffusion coefficient is selected, in accordance with a combination of color components of the target pixel, from a diffusion coefficient table which stores a diffusion coefficient for diffusing a quantization error in accordance with a combination of color component values of a pixel, and an error value is added to the target pixel in accordance with the selected diffusion coefficient.